

Field and Laboratory Evaluation of Trunk Injection with Three Insecticides for Controlling the Palm Stem Borer *Oryctes elegans* Prell in Babylon Province, Iraq

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ABSTRACT

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The palm stem borer, *Oryctes elegans*. Pell, is considered one of the most destructive pests attacking date palm trunks in the middle Euphrates region. In Babylon governorate, many old orchards suffer from severe infestation, which often leads farmers to cut the trees. During 2024-2025, we conducted both laboratory and field trials at Al-Mussaib Technical College and in three private orchards in Babylon. In the laboratory, 90 last instar larvae were tested (10 larvae for each replicate, three replicates per insecticide). In the field, we used 72 palm trees distributed in three orchards following Randomized Complete Block Design. Each orchard contained 24 palms: 9 for trunk injection, 9 for conventional spraying, and 6 as untreated control. For injection, we drilled a hole of about 0.5 cm diameter and 12 cm depth at a 45-degree angle, at 1.5 m height, injected 1 liter solution per palm and closed the hole with wax. Three insecticides were evaluated: Carbaryl (20 g/L), Fipronil (2 ml/L), and Chlorpyrifos 48% (3 ml/L). After 24 hours in lab, mortality was 79.0% for Carbaryl, 74.26% for Fipronil, and 63.26% for Chlorpyrifos. Statistical analysis showed significant differences ($F = 14.51$, $p = 0.0050$, $LSD_{0.05} = 7.33$). After five days, mortality increased to 85.66%, 78.43%, and 72.63% respectively ($F = 8.60$, $p = 0.0172$, $LSD_{0.05} = 7.70$). Under field conditions, light trap catches decreased from 13 to 0 insects/trap for Carbaryl (100% reduction) and from 15 to 0 for Fipronil (100%), while Chlorpyrifos decreased from 14 to 2 (85.7%). These results indicate that trunk injection, particularly with Carbaryl, can achieve complete control after three months and could be recommended for Babylon orchards.

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1. INTRODUCTION

Date palm cultivation began in Mesopotamia around 4000 B.C. Despite long history, Babylon orchards face bulldozing, water scarcity and spread of pests due to lack of mechanization and care. Palm is infested by many pests including *Oryctes elegans* which bores inside trunk causing damage. Traditional spraying is ineffective because larvae inside trunk. Trunk injection is modern safe (Al-Deeb et al 2021, mogahed 2023). technique where insecticide trans located via xylem and phloem to all tissues. This research aims to use three pesticides to control this pest in Babylon. Similar to findings in UAE (Al-Deeb et al., 2021) and Iran (Latifian & Rad, 2019), our results

2. MATERIALS AND METHODS

2.1 Laboratory: Entomology lab Al-Mussaib Technical College. 10 larvae per replicate, 3 replicates per treatment, total 90 larvae. Larvae fed on sawdust + frond tissue. Mortality recorded after 24h and 5 days.

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2.2 Field: 3 orchards in Babylon Province. RCBD with 3 blocks. 24 palms per orchard: 9 palms trunk injection (3x3), 9 palms spraying, 6 control. Injection: electric drill 0.5cm diameter, 12cm depth, 45° angle, 1.5m height above ground, 3 holes per palm, 1 liter insecticide solution per palm, sealed with wax. Two applications: autumn after harvest and before pollination. Light trap 1 per orchard monthly.

2.3 Statistics: ANOVA, LSD at $p < 0.05$.

3. RESULTS

Table 1. Mortality after 24h

Treatment	Repicates	Mean	SE	Group
Carbaryl 20g/L	80,75,82	79.0	2.28%	a
Fipronil 2ml/L	77.5, 68.8,76,5	74.26	2.75%	ab
Chlorpyrifos	62.6,65.7,63.5	63.26	1.25%	b
Control	0,0,0	0	0	c

Treatment | Mean $\pm$ SE | SD | Group

Carbaryl 20g/L | 79.0 $\pm$ 2.08% | 3.60 | a

Fipronil 2ml/L | 74.26 $\pm$ 2.75% | 4.76 | ab

Chlorpyrifos | 63.26 $\pm$ 1.25% | 2.17 | b

ANOVA: $F(3,8)=14.51$, $p=0.0050$, $LSD_{0.05}=7.33$

Table2. Mortality after 5 day

Treatment	Mean	SE	Group
Carbaryl 20g/L	85.66	2.33%	a
Fipronil 2ml/L	78.43	2.52%	ab
Chlorpyrifos	72.63	1.74%	b

$F(2,6)=8.60$, $p=0.0172$, $LSD_{0.05}=7.70$ Interpretation: Efficacy increased with time due to systemic translocation. Carbaryl achieved highest mortality.

Table 3.

Treatment	Befor	After 1m	After 3m	Reduction
Carbaryl+ injection	13	6	0	100%
Carbaryl+ spraying	12	10	9	25%
Fipronil + injection	15	6	0	100%
Fipronil+ spraying	14	11	11	21.4%
Chlorpyrifos+injection	14	8	2	85.7%
Chlorpyrifos+ spraying	13	10	10	23%
Control	13	14	15	0%

Field light trap (insect/trap/month)

Carbaryl: Before 13, After 1 month 6, After 3 months 0 = 100% reduction

Fipronil: Before 15, After 1 month 6, After 3 months 0 = 100% reduction

Chlorpyrifos: Before 14, After 1 month 8, After 3 months 2 = 85.7% reduction

Figure 1. Laboratory mortality (%) after 24h and 5 days
(Mean $\pm$ SE, n=3, LSD0.05 24h=7.33, 5d=7.70)

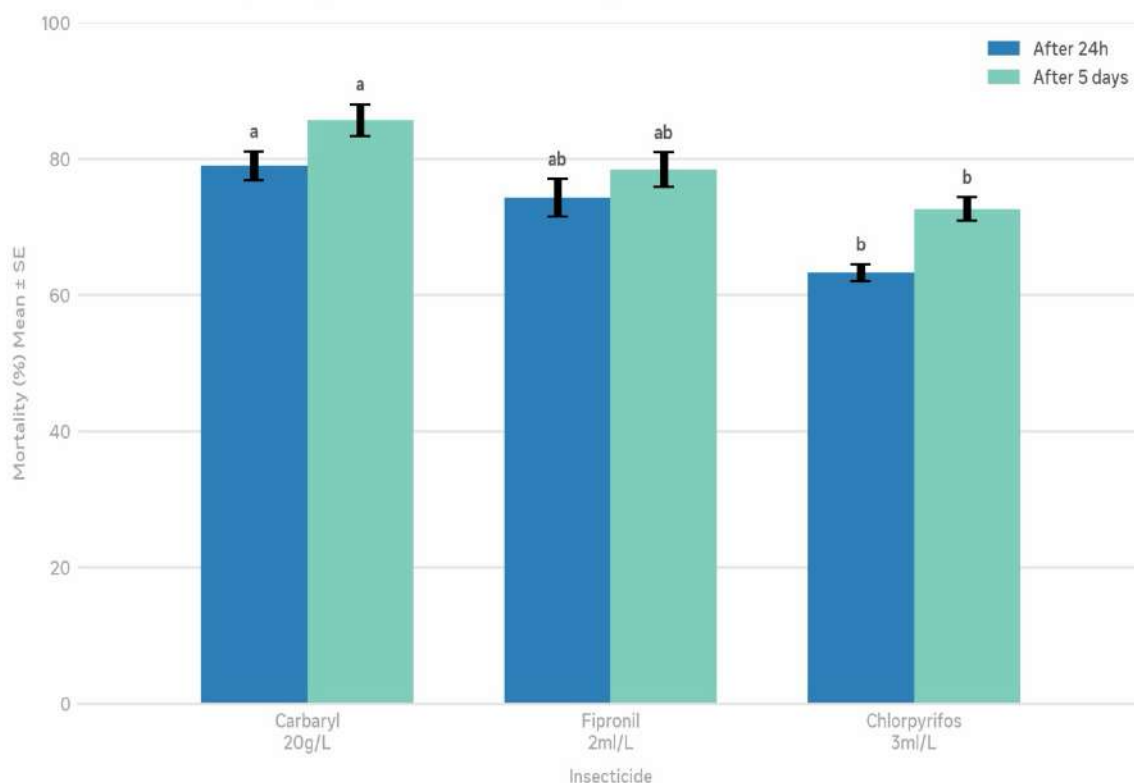


Figure 2. Field population in light trap before and after treatment
Solid=Injection, Dashed=Spraying

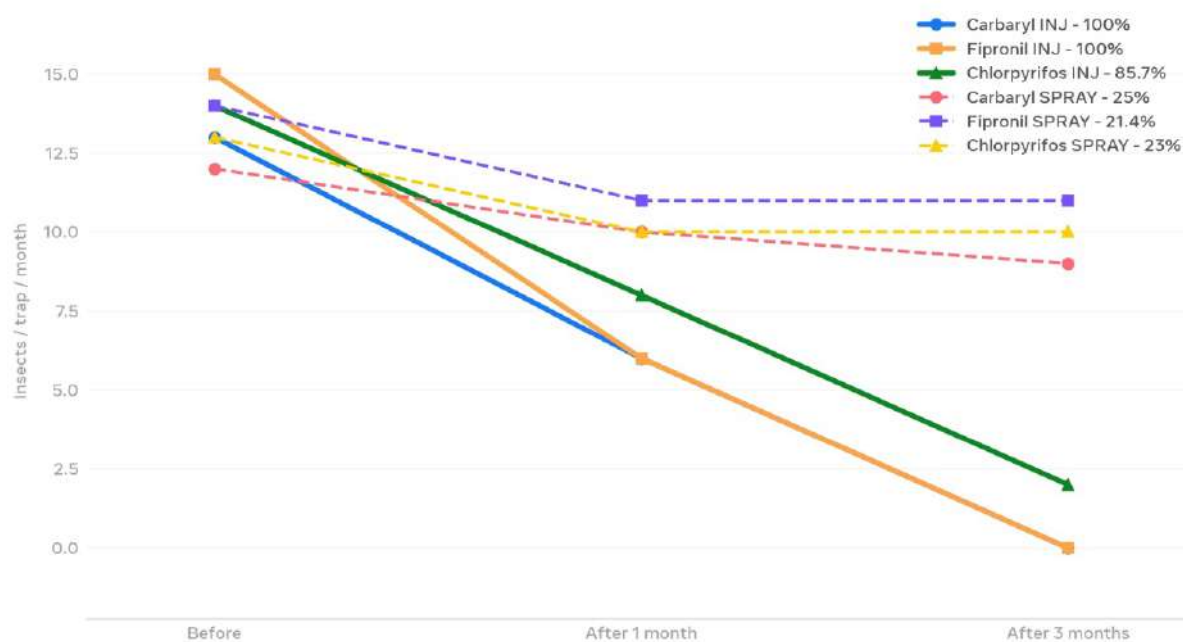


Figure 2. Field population in light trap before and after injection

Figure 3. Schematic diagram of trunk injection technique

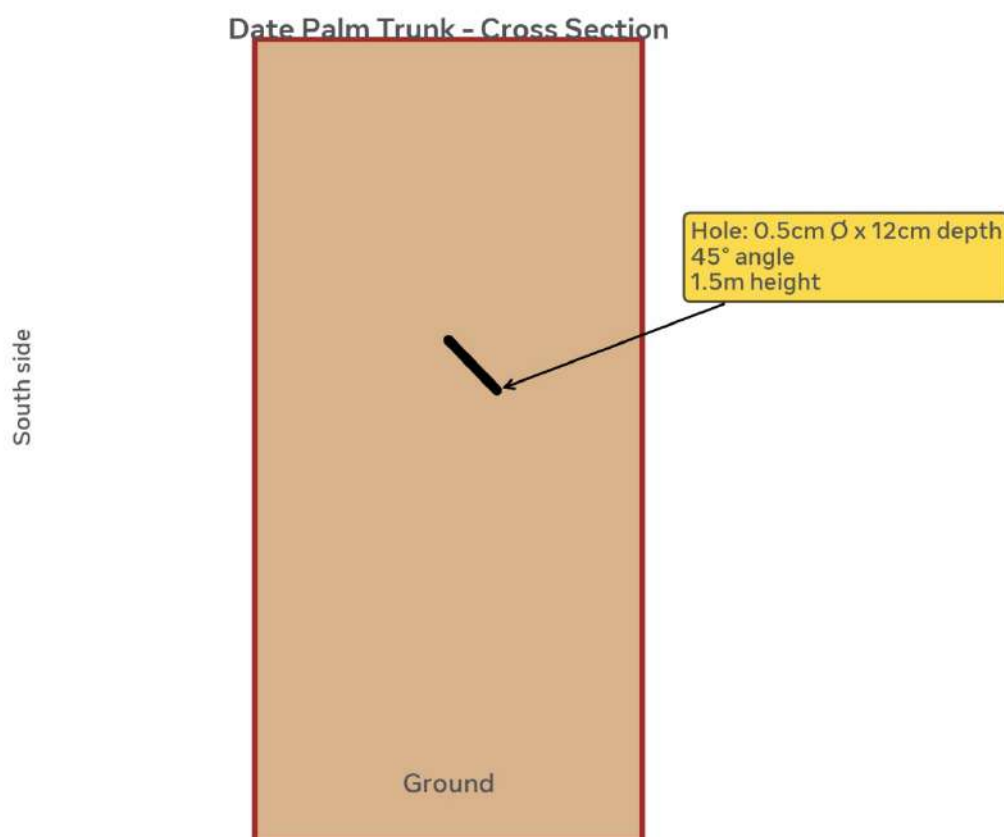


Figure 3. Schematic diagram of trunk injection technique (0.5cm x 12cm x 45° x 1.5m)



Figure 4. Adult of *Oryctes elegans* on date palm trunk (photo; H.Naas,Babylon 2024)

4. DISCUSSION

Our results agree with Al-Deeb et al. 2021 in UAE who achieved 100% reduction by trunk injection against *Oryctes*. Carbaryl superiority due to systemic movement via xylem and phloem reaching boring larvae. Chlorpyrifos less effective due to low systemic property. Technique (0.5cm x 12cm x 45° x 1.5m) is safe and prevents leakage and closes with wax prevents infection. Our injection technique (0.5cm x 12cm x 45° x 1.5m) agrees with Mogahed (2023) who reported 91.7% recovery with injection 745a and Al hewairini (2023) who recommended pressure <1 bar for injection 676a`

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5. CONCLUSION

1. Carbaryl 20g/L trunk injection most effective: 79% after 24h, 85.66% after 5 days lab, 100% field reduction after 3 months.
2. Injection technique effective and environmentally safe compared to spraying.
3. Recommend two applications per year: autumn after harvest and before pollination.
4. Recommend adoption in Babylon orchards to prevent palm bulldozing.

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